REMARKS/ARGUMENTS

Status of the Application

Prior to the entry of this amendment, claims 55-82 were pending in this application. In the Office Action all claims were rejected under 35 U.S.C. § 102(b) and/or 35 U.S.C. § 103(a).

The present amendment cancels claims 57 and 68-70. Claims 55, 71 and 82 have been amended. Claim 83 has been added. Thus claims 55, 56, 58-67 and 71-83 are now presented for further examination.

Claim 55 has been amended to require the anionic surfactant to be a dimer, trimer or oligomer as previously required by the third bullet point of the claim. Both claim 55 and claim 71 have been amended to require the formation to be a reservoir with a temperature of at least 100 deg. C (== 212 deg.F.). That is supported by page 7 line 5 to 11, especially line 10, of the text. Claim 82 has been amended to call for a viscosity above 50cp at $100s^{-1}$ as specified at page 11 line 3. New claim 83 is a copy of claim 82 but dependant on claim 55.

No new matter is added by the amendments.

35 USC 102 rejections

Claims 55-66 and 68-82 stood rejected over US 6435277 (Qu). Claims 55 and 71 have been amended to specify a reservoir temperature of at least 100 deg C (=at least 212 deg F). Qu does not teach that a formulation should be used at such a temperature and indeed frequently refers to temperatures below 200 deg F. See for instance col 10 line 34 describing Fig 14 and col 11 line 10 describing Fig 23. This requirement for a formation temperature above 100 deg. C thus gives novelty over Qu. Furthermore, Claim 55 has also now been amended to specify that the anionic surfactant is a dimer/trimer/oligomer. Such surfactants are not mentioned by Qu and so claim 55 is novel for this additional reason.

Claims 55-58, 60-66, 68-74 and 76-80 stood rejected over Zhou US2002/064946. Of course fracturing is the main use of Zhou's compositions but the temperature of the formation does not appear to be disclosed. Thus, applicants submit that Zhou does not disclose the requirement for a formation temperature over 100 deg. C and consequently the independent claims 55 and 71 as amended are novel over Zhou.

Moreover, as regards claim 55 now amended to require dimer/trime/oligomer, those portions of Zhou which disclose monomeric anionic surfactants no longer take away novelty of claim 55. Examples 5 and 6 of Zhou refer to dimer of oleic acid. Applicants continue to believe that Example 5 shows experimental work and does not disclose use of its experimental compositions in the fracturing of a formation. As is plain it its claim 1, Zhou requires two surfactants, one of which has viscoelastic properties, the other of which displays degradation over time to liberate a viscosity breaker. In Example 5 the first surfactant is oleate but the second surfactant is missing. The example serves to show the effect of deliberately adding oleyl alcohol as the breaker which would be liberated by degradation of the second surfactant. This is apparent by comparison with Example 6 where oleyl ester succinate which liberates oleyl alcohol upon degradation is included as the second surfactant in accordance with the invention of Zhou, but oleyl alcohol is absent (and would be absent from the fluid injected into the wellbore), and appears only later when it is released through degradation of the second surfactant.

Claim 67 stood rejected as anticipated or in the alternative as obvious over Qu. Claims 67, 81 and 82 stood rejected as anticipated or in the alternative as obvious over Zhou. Both of these rejections were made on the basis that properties are inherent in the composition. In light of this claims 55 and 71 now state the reservoir temperature and thus define a process step. It is respectfully submitted that this overcomes rejection on ground of anticipation.

It is respectfully requested that rejections under 35 USC 102 are withdrawn.

35 USC 103 rejections

As has been mentioned previously, it is generally the case that viscoelastic surfactants require some salt to be present in order to retain the property of viscoelasticity as temperature is increased. Figure 2 of the present application shows that a dimeric surfactant has a viscosity over 100cP at temperatures up to about 60°C if only 4wt% KCl is used, but maintains viscosity of this magnitude up to 120°C if 8wt% KCl is used. The present inventors have found that this retention of viscoelasticity at elevated temperature can be achieved with a lower percentage of salt by including a modest proportion of a compound with hydrophilic and lipophilic properties, such as oleyl alcohol for instance. This is demonstrated in the specification and drawings, in particular Figure 3 which shows the temperature at which viscosity falls being shifted markedly to higher temperatures.

Zhou is concerned with compositions in which liberation of oleyl alcohol (or other compound) can break the viscosity after a period of time. Zhou does not teach injecting a fracturing fluid in which oleyl alcohol is already present and does not recognize that including a nonionic material within the limitations of present claims 55 or 71 can enhance viscosity and the retention of viscosity at temperature.

Reading Zhou's Example 5 in isolation, the reader learns that the dimeric surfactant has a tolerance of oleyl alcohol, but is not told why it is included. However, on reading the text more generally, and notably at the top of page 26 within Example 6, it is mentioned that delayed release of oleyl alcohol can act as a delayed breaker, serving to reduce viscosity after a delay. Nothing here is teaching what composition to use as a fracturing fluid when reservoir temperature exceeds 100 deg C. Zhou **teaches away** from the present invention by teaching the use of two surfactants, one of which degrades to liberate oleyl alcohol after injection into the formation. Moreover, Zhou also **teaches away** from the invention by presenting lower alcohols as reducing viscosity (bottom page 18 and top line page 19) and so does not disclose *viscosity enhancing* by alcohol.

As has been mentioned previously, in claim 55, the hydrophilic-lipophilic compound is referred as *viscosity enhancing* and in claim 71 it is required that it enhances viscosity within a stated temperature range.

In Qu, Examples 22 and 23 use octanol with potassium oleate. The weight percentages are roughly equal but the molecular weight of octanol is much less than that of potassium oleate and so there is a large molar excess of octanol over oleate. This is in complete contrast to claims 55 and 71 which requires that the molar ratio of nonionic compound to anionic surfactant is not over 0.5. There is no teaching that the octanol is enhancing viscosity or enhancing the temperature range at which viscosity is observed. The amount of surfactant incorporated in these Examples is high. It gives a very high viscosity at temperatures below 100 deg F, and then drops to a lower viscosity. There is no indication of shifting of the temperature at which viscosity drops, in the manner illustrated in Figure 3 of the present application.

Applicants therefore respectfully make the following submissions:

Claim 71 as now amended is not obvious from Qu or Zhou because neither document enables its reader to learn that incorporation of a limited amount of oleyl alcohol or other specified non-ionic compound will enable satisfactory viscosity to be achieved at elevated temperatures, thus making the composition suitable for injection into a reservoir with temperature above 100 deg.C.

In addition, claim 55 is not obvious from Qu because it does not disclose the required anionic surfactant. Claim 55 is not obvious from Zhou Example 5, because Zhou does not teach incorporating a non-ionic compound before injecting into the wellbore as a means of enhancing viscosity. Qu does not teach what is missing from Zhou and so does not lead from Zhou Example 5 to the invention as now claimed.

For these reasons it is respectfully submitted that the reader of Zhou and Qu would not be led to combine these documents in a way which provides all the requirements of claim 55.

Many of the dependent claims further distinguish over the prior art. In particular, claims 82 and 83 call for viscosity enhancement up to 130 deg. C.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

In the event that a fee or refund is due in connection with this Amendment, the Commissioner is hereby authorized to charge any underpayment or credit any overpayment to Deposit Account No 19-0615. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned.

Respectfully submitted,

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